Claims:

1. Method of electrolytically forming conductor structures from highly pure copper on semiconductor substrate surfaces, provided with recesses, when producting integrated circuits, more especially in recesses having a high aspect ratio, with the following method steps:

a. coating the semiconductor substrate surfaces, which are provided with the recesses, with a full-surface basic metal layer in order to obtain sufficient conductance for the electrolytic deposition;

b. full-surface deposition of copper layers having a uniform layer thickness on the basic metal layer by an electrolytic metal deposition method by bringing the semiconductor substrates into contact with a copper deposition bath,

   i. the copper deposition bath containing at least one copper ion source, at least one additive compound for controlling the physico-mechanical properties of the copper layers as well as Fe(II) compounds and/or Fe(III) compounds, and

   ii. an electric voltage being applied between the semiconductor substrates and dimensionally stable counter-electrodes, which are insoluble in the bath and are brought into contact therewith, so that an electric current flows between the semiconductor substrates and the counter-electrodes;

c. structuring the copper layer.

2. Method according to claim 1, characterised in that the current is changed with a sequence of uni- or bipolar pulses per unit time.

3. Method according to claim 2, characterised in that the current is changed with a sequence of bipolar pulses per unit time, comprising a sequence of cathodic pulses lasting from 20 milliseconds to 100 milliseconds and anodic pulses lasting from 0.3 milliseconds to 10 milliseconds.

4. Method according to one of claims 2 and 3, characterised in that, in the case of bipolar pulses, the peak current of the anodic pulses is set to at least the same value as the peak current of the cathodic pulses.

5. Method according to one of claims 2 to 3, characterised in that, in the case of bipolar pulses, the peak current of the anodic pulses is set to two to three times as high as the peak current of the cathodic pulses.

6. Method according to one of the preceding claims, characterised in that at least one additive compound is used, selected from the group comprising polymeric oxygen-containing compounds, organic sulphur compounds, thiourea compounds and polymeric phenazonium compounds.

7. Method according to one of the preceding claims, characterised in that inert metals, coated with noble metals or oxides of the noble metals, are used as the dimensionally stable, insoluble counter-electrodes.

8. Method according to claim 7, characterised in that expanded titanium metal, coated with iridium oxide and irradiated by means of fine particles, is used as the counter-electrode.

9. Method according to one of the preceding claims, characterised in that the concentration of the compounds of the copper ion source in the copper deposition bath is kept constant per unit time, because copper parts or copper-containing shaped bodies are brought into contact with the copper deposition bath, and copper is dissolved by reacting with Fe(III) compounds and/or Fe(III) ions contained in the bath.